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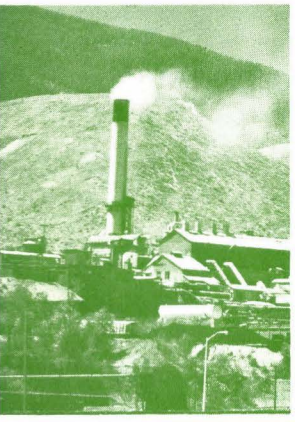

FOREST INSECT & DISEASE MANAGEMENT

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EVALUATION OF MOUNTAIN PINE BEETLE INFESTATION HEBGEN LAKE RANGER DISTRICT, GALLATIN NATIONAL FOREST MONTANA - 1978

by

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ABSTRACT

Mountain pine beetle populations developed to epidemic level in 1970 on the Hebgen Lake Ranger District. Infested acreage increased from 78,000 in 1977 to 79,061 in 1978. More than 4 million trees (238 MMBF) were killed in 1978. Cold temperatures during December 1978 may cause a significant decline in the beetle population, resulting in a decline in the number of newly attacked trees in 1979. Potential mortality from the beetle can be reduced and prevented through an accelerated program of (1) logging infested trees, and (2) silvicultural treatment of green and infested stands to reduce the inventory of large diameter highly preferred trees.

High valued lodgepole pine in recreation and administrative sites should be sprayed with the preventative chemical, Sevimol-4®, to protect trees from beetle attack until the epidemic declines.

INTRODUCTION

Mountain pine beetle 1/ developed to epidemic level in uneven-aged lodgepole pine stands on the Hebgen Lake Ranger District in 1970 (Ciesla 1971; McGregor and Tunnock 1971). Since 1970, infestation has continued to envelop susceptible stands from the Moose Creek Plateau, along the Yellowstone Park border on the south end of the District, to Tepee Creek on the north end of the District. Tree killing increased significantly along the west side of Hebgen Lake and throughout the southwest portions of the District toward Targhee Pass along the Continental Divide.

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MOUNTAIN STA

1/ *Dendroctonus ponderosae* Hopkins.

Groups of faders have become more evident in stands along the south side of the Madison River, Quake Lake, and in the Beaver Creek campground.

Infested area increased from 78,000 acres in 1977 to 79,061 acres in 1978 (figure 1). Plots were established throughout the District to obtain tree and volume loss estimates and buildup ratios. This information can be used for predicting infestation trend, providing data so logging can be directed in areas experiencing severe mortality and in stands of potential high mortality, and for planning protection of high use areas. Plot data gives number of newly infested trees/acre, buildup ratios, and predicted infestation trend.

METHODS

Tree and volume loss estimates and buildup ratios were based on 200 variable (BAF = 10) plots located on lines at 5-chain intervals in 20 locations (figure 1). Relaskops were used to determine trees to be tallied within plots. All green and infested trees 5 inches diameter breast height (dbh) and larger were placed into one of these classes:

0 = Healthy trees
1 = Unknown or natural mortality
2 = Current beetle attack
3 = 1-year-old attack
4 = 2 years and older beetle attack
5 = Unsuccessful attack

Heights were recorded on two trees of each species that occurred per plot for estimating volume loss. Data were analyzed using the computer program INDIDS (Bousfield 1977). High use sites were 100 percent cruised for 1978 successfully attacked trees.

RESULTS

Infestation intensity--Infestation intensity by year is shown in table 1. Trees and volume killed/acre have increased yearly from 1976 to 1978. In areas evaluated, trees killed/acre averaged 10.9 (range 0.7-25.7) in 1976; 27.4 (range 0-59.4) in 1977; and 60.3 (range 10-144) in 1978. Based on acreage infested, accumulated from faders mapped during aerial detection surveys, over 4.7 million trees were killed in 1978. This is a 1:2.2 buildup ratio from 1977 to 1978. Volume killed averaged 607.4 bd ft/ac (range 99.9-2,579.1) in 1976; 1,500.6 (range 482.7-3,686.4) in 1977; and 1,885.6 (range 61-5,310.4) in 1978.

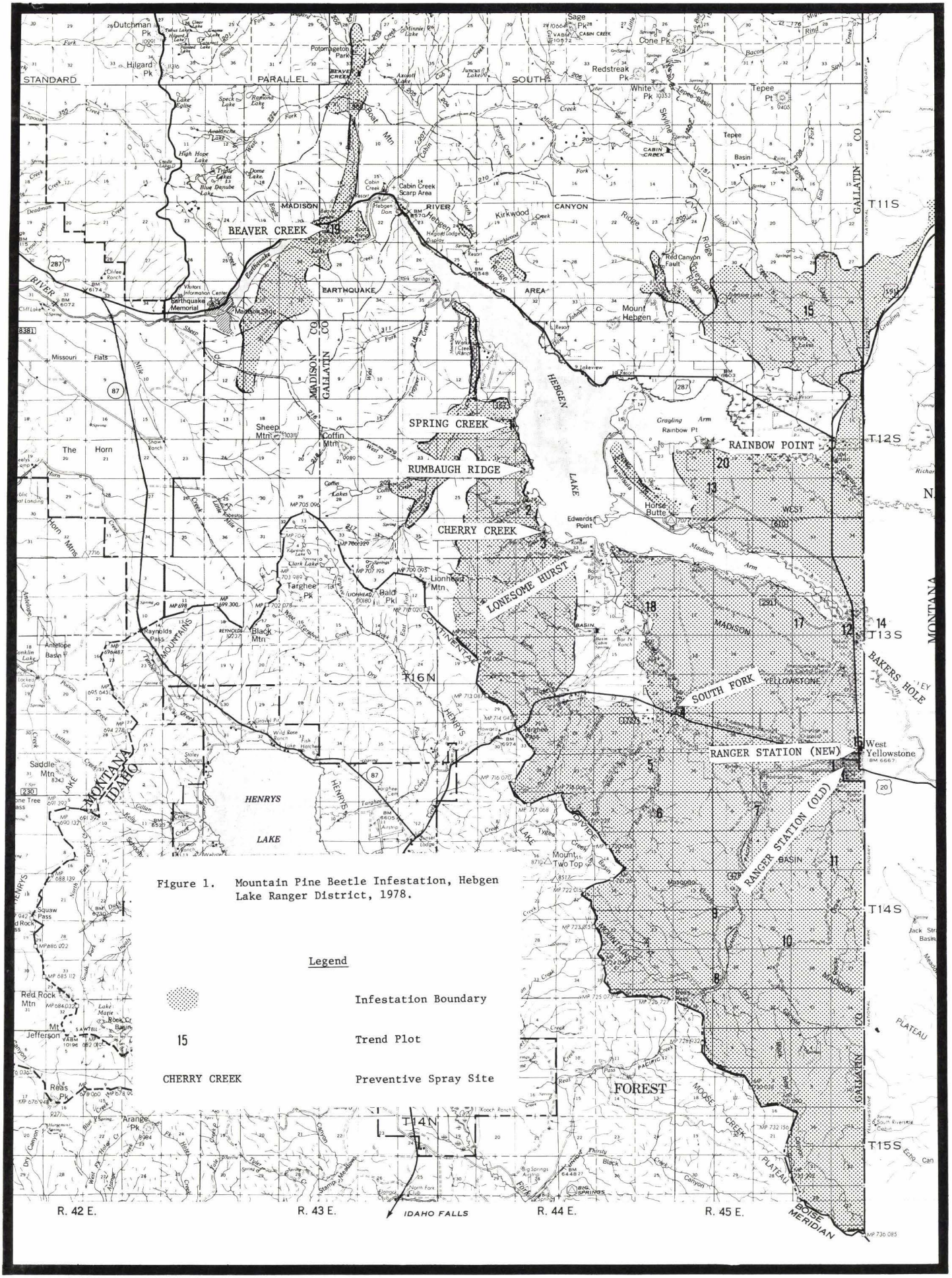

Figure 1. Mountain Pine Beetle Infestation, Hebgen Lake Ranger District, 1978.

Table 1--Trees and volume killed by mountain pine beetle, Hebgen Lake Ranger District, Gallatin National Forest 1976 - 1978

Plot	Trees killed/acre			Volume killed/acre		
	1976	1977	1978	1976	1977	1978
Spring Creek	1.5	5.0	27.9	344.1	541.6	4511.4
Rumbaugh Ridge	4.2	3.2	95.4	191.7	537.2	4039.3
Cherry Creek	10.5	16.9	51.0	892.2	2573.5	3451.0
South Fork	0.7	16.4	144.0	134.6	2312.4	5310.4
E. Cream Creek	8.6	9.0	18.3	686.6	482.7	780.5
E. Cream Creek	8.3	21.2	64.9	270.0	2433.3	3298.8
Corette Ridge	25.7	59.4	64.8	2180.0	3686.4	1933.1
Dry Canyon	7.9	120.1	91.8	251.8	1529.8	61.0
Mosquito Gulch	14.4	33.8	66.1	988.1	1496.7	947.2
Rock Draw So.	24.0	35.0	70.0	2579.1	1789.2	1790.9
Rock Draw North	23.6	31.6	144.0	503.6	564.1	667.9
Bakers Hole	2.1	19.8	98.9	99.9	910.0	939.1
Horse Butte	3.2	31.9	31.6	482.6	1673.4	795.8
Madison River	22.0	33.0	67.5	249.3	1623.4	822.1
Grayling Creek	7.7	27.5	54.3	966.1	1557.9	858.7
Hebgen Lake RS	1.0	22.3	36.6	142.2	1963.8	892.7
Upper Madison River	11.1	21.6	36.9	214.7	755.2	1370.4
Bar N Ranch	8.6	9.5	18.1	465.8	1239.4	1984.1
Quake Lake	3.4	12.4	10.0	262.1	842.1	1475.1
Rainbow Point	4.3	0	14.3	243.6	0	1783.4
Average	10.9	27.4	60.3	607.4	1500.6	1885.6

Almost all tree mortality in 10 high use areas (recreation and administrative sites) was prevented by spraying all trees > 7 inches dbh, with the preventative spray Sevimol-4 (figure 1). District personnel sprayed 10,877 trees between May 8 and June 22. Results of spraying are shown in table 2.

Only 18 trees that were sprayed were killed; 19 sprayed trees were pitch-outs; and 9 sprayed trees were strip attacked.

Table 2--Summary of high use areas sprayed with Sevimol-4 to prevent mountain pine beetle attack

Area	No. 1977 attacked trees	No. trees sprayed	Gallons sprayed	Sprayed trees attacked		
				Strip attacks	Pitch-outs	Killed
Cherry Creek Campground	120	410	32	1		3
Rumbaugh Ridge Campground	40	272	20			1
Spring Creek Campground	18	234	12			
Lonesomehurst Campground	138	176	8	5		2
South Fork Campground	591	841	64	3	4	1
Bakers Hole Campground	858	1,902	99		6	9
Rainbow Point Campground	528	3,743	224		3	
Beaver Creek Campground	126	2,415	208			
Hebgen Lake Ranger Station	570	855	52		6	2
Hebgen Lake Work Center	38	29	2			
Total	3,027	10,877	721	9	19	18

DISCUSSION AND RECOMMENDATIONS

Mountain pine beetle killed lodgepole pine were detected on more than 79,000 acres during our annual aerial insect and disease detection survey. Ground plots show approximately 60 newly attacked trees/acre. Using this average, over 4.7 million trees containing 238 MMBF of merchantable timber were killed in 1978.

In an effort to manage stands, reduce infestation levels, and prevent infestation from developing in green stands, the District contracted salvage logging for 4.8 MMBF on 1,028 acres. An additional 1,730 acres of lodgepole pine type will be logged during 1979.

We predict a decline in number of infested trees will occur on the Hebgen Lake Ranger District in 1979. Minimum temperatures for 6 consecutive days during December were: -48°, -50°, -53°, -56°, -50°, and -48° F. and high temperatures never exceeded -15° F. Evaluations later this spring should verify if the population declines.

Sufficient beetle populations may exist to continue the infestation, but fewer trees will likely be killed during 1979.

Pine snags in high use areas create problems of shedding needles and dead branches; also portions of the crown or trunk may be weakened by disease. Falling snags increase hazards to humans and property. Protecting high valued trees until the infestation subsides will prevent the need to rehabilitate campgrounds and administrative sites by planting to enhance esthetic values. The 99.8 percent survival of sprayed trees shows the effectiveness of spraying to protect these high value areas.

RECOMMENDATIONS

Stands where loss is predicted to continue at a high level can be managed in the following ways, depending upon land use objectives (Amman et al. 1977):

1. Since the beetle concentrates heavily on large diameter, older trees, continuous forests can be broken up by small clearcuts, which will result in different age and size classes and thus reduce the area likely to be infested at any one time. High risk stands should be harvested as they mature.

2. Because the beetle shows preference for large diameter trees, selective cutting prior to beetle attack will greatly reduce infestation

potential. Removal of trees $\geq$ 7.9 inches dbh will "beetle-proof" most lodgepole stands. When partial cuts are prescribed, the residual stand should be numerically adequate and physically vigorous to maintain stocking and stand productivity, and not reduce visual quality.

Partial cutting may not be the best method of managing beetle populations in understocked or in overstocked stands, particularly if trees are on highly productive sites and growing well. In such stands, a high proportion of trees in diameter classes $\leq$ 7.9 inches dbh may have thick phloem which is conducive to beetle production. These trees may then maintain the infestation at epidemic level. Clearcutting and regenerating these stands may be the best method of management.

3. Another management alternative for particularly susceptible stands is to favor nonhost trees such as Douglas-fir. In mixed species forests, nonhost trees will result in greater residual stocking should an outbreak develop. Data show that the beetles infest lodgepole pine in mixed species forests as readily as in pure forests (Amman and Baker 1972; Hamel and Oakes 1977). Conversion to another species (Douglas-fir, spruce, or subalpine fir) may result in depredations by other insects such as western spruce budworm 1/, Douglas-fir beetle 2/, spruce beetle 3/, or the western balsam bark beetle 4/.

Potential losses from the mountain pine beetle can be minimized through an accelerated program of (1) logging infested trees, and (2) silvicultural treatment to reduce the inventory of large diameter, thick-phloemed, high risk trees. This should be directed to those stands rated as moderate and high hazard as to susceptibility to beetle attack. Recurring epidemics can be expected until the average tree diameter of the stand is reduced to < 7.9 inches dbh, and average age is reduced to < 80 years.

4. High valued recreation and administrative sites should be sprayed with the protective chemical Sevimol-4 to prevent mountain pine beetle attack until the epidemic subsides.

1/ Choristoneura occidentalis Freeman
2/ Dendroctonus pseudotsugae Hopkins
3/ Dendroctonus rufipennis (Kirby)
4/ Dryocoetes confusus Swaine

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